# Advancing the Understanding of Biosafety

## Latest scientific findings,

## policy responses and public participation

## Lecture

## Hope not Hype: The Future of Agriculture

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**Session**

**Reality Checks**

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A synthesis of the best science on agriculture was the immodest goal of a project initiated in 2003 under the title of the International Assessment of Agricultural Knowledge, Science and Technology for Development, abbreviated as IAASTD (Heinemann, 2009). It was a joint project of the world's major agriculture and development institutions initiated by the World Bank and conducted in partnership with the United Nations Food and Agriculture Organization (FAO), UN Environment Programme (UNEP), UN Development Programme (UNDP), UN Educational, Scientific and Cultural Organization (UNESCO), World Health Organization (WHO) and the Global Environment Facility (GEF) (IAASTD, 2008).

The large Assessment is comprised of a multi-chapter global and five multi-chapter sub-global reports with two overarching documents, the Global Summary for Decision Makers (SDM) and the Synthesis Report (SR). The entire project was supervised by a multi-stakeholder governing Bureau composed of representatives of the funding agencies, governments, private sector and Non-Governmental Organizations (NGOs). It is the single largest and most diverse global appraisal of agriculture ever undertaken (Rivera-Ferre, 2008). Hopefully, it has not been completed too late. Agriculture is coming under greater scrutiny than ever before as it is increasingly clear that the benefits and impacts of agriculture are not evenly shared between the rich and the poor. The Assessment was set the ambitious task of answering the central question of how will agriculture in 2050 contribute to a well fed and healthy humanity despite the challenges of vast environmental degradation, population growth and climate change, and do so in a way that the potential to produce food has not been lost because of how we farm. One answer was simple: Buisness as usual is not an option. How we farm now will fail to achieve this goal. How should we farm was not as easy a question to answer.

No one can know for sure if there will be a technology capable of feeding the world forever. At least for now, we must be as concerned with our appetites as we are with our capacity to produce food, fuel and materials. The Assessment had hard words for the societies that have long disproportionately consumed. Harder words still for their attempts to maintain their consumption using subsidies and market distorting trade mechanisms and asymmetric intellectual property rights (IPR) frameworks. What is clear is that genetic engineering cannot feed the world, at least not the way we have been developing and using it.

**What the Assessment found with regard to GMOs was:**

1. There is no evidence of a general, sustained or reliable increase in yield from GM crops over the 14 years since the first commercial release.
2. There is no evidence of a sustained reduction in costs to farmers adopting GM crops, nor a sustained and reliable increase in profits to such farmers.
3. There is no evidence of a sustainable reduction in pesticide use. In fact, there is a dramatic increase in some herbicides and the special way that they are used on GM crops is undermining the conventional farmer's weed control options.
4. The overwhelming majority of GM crops were not designed to increase yield, they were designed to sell particular agrochemicals or biological insecticides.
5. There is no evidence that genetic engineering has produced crops needed by the majority of the world's farmers.
6. The wholesale grab of plant germplasm as the intellectual property of a few mega corporations is consolidating the seed industry and threatens long term plant

agrobiodiversity and biodiversity. Should GM animals ever become viable commercial products, there is every reason to expect the same contraction in animal germplasm.

New GMOs must be subject to uniform safety and ecological assessments of higher standard, transparency and independence than has benefited existing GM crops. The adoption of GM crops is consistent with a number of "oversimplification", or monoculturalization, trends in agriculture over the last few decades. The most literal are the large monocultures that characterize cropping systems in countries such as the US, Canada, Argentina, which also boast some of the biggest GM crop production. Monocultures require high levels of external inputs to attempt to restore the soil and high pesticide use because of the large populations of specialist pests that they support. Oversimplification of the agricultural landscape through both intensive plant and animal monocultures undermines agroecosystem resilience and thus sustainability. GM crop commercialization shows no signs of working outside the monoculture model. The attempt to simplify pest management through genetic engineering has resulted in increased applications of a very small number of agrochemicals. This practice has increased the frequency of resistance to those chemicals and reduced the diversity of alternative products. Consequently, it threatens the sustainability of yields in both GM and non-GM agroecosystems. Finally, the industrial model of agriculture is also correlated with the oversimplification of diets (Chávez and Muñoz, 2002, Hawkes, 2006, Scialabba, 2007, Tee, 2002). In many countries, malnutrition is marked by both larger numbers of the underweight and the overweight, often within the same households. The source of fats, proteins and carbohydrates are from a smaller number of kinds of plants and animals leaving people vulnerable to disease because of micronutrient malnutrition.

**What the Assessment found with regard to other solutions was:**

1. There is substantial evidence that investment in agroecological methods would contribute to feeding the world in a sustainable way.
2. We must immediately re-invest in proven technologies such as conventional breeding and marker assisted breeding.
3. IPR frameworks must be urgently revised. If biological material is to continue to be protected by patent and patent-like instruments, then the way in which intellectual property is described and the incentives on public institutions to develop intellectual property must be changed.
4. Large agriculture exporting countries must immediately adopt trade and aid policies that promote food security and sovereignty outside their own borders.

What characterizes the present is that the world lacks the will and not the means to feed everyone. What characterizes the future is that we may also lack the means. We must prepare now for that day.

The purpose of this talk is not to pit genetic engineering against other biotechnologies, but to chart the course for development of the right biotechnology to meet our mutual goals of having plentiful nutritious and tasty foods that are fit for purpose and locally prized, and to do so without losing the ability to continue to feed future generations. It is also essential that the pathway to this future of food also strengthens local communities and builds local economies. The Assessment is confident that the pathway to feeding the world in a sustainable way will not only achieve a more resilient agriculture, in the process it will restore our diverse global ecosystem and halt the loss of our diverse human agricultures. To the degree that modern biotechnology, genetic engineering included, can contribute and be compatible with

these larger social and ecological solutions, it is welcome. But it is time, as they say, for GMOs to put up or shut up.

To feed the world and build sustainable agroecosystems and societies at the same time will require more than current knowledge of agroecology (Tilman et al., 2002). Governments, philanthropists and industry must invest in research and institutions that will build knowledge and improve methodology, as well as help to customize implementation. This knowledge must be made in collaboration with farmers and be distributed through extension services, non-governmental organizations, and the private sector.

Can the world follow agroecological agriculture and make a profit? The likelihood is high but there is no question that we need new economic models. To meet the goals discussed above requires more than tinkering with technology and tariffs. We need to be able to account for the true cost of using non-renewable resources, such as fossil fuels. The value of “marginal land” and water as ecosystem services must be identified. The contribution of in situ conservationists, largely farmers, must be recognized. Ultimately, we have to change the question from “How much can be made on the crops from this land, or the animals grazed on this paddock?” to “How much will it cost to not have this land, these crops, these animals or these farmers?”.

The right biotechnologies are both sophisticated and effective at what they do. “A frequent misconception is that organic agriculture means turning back the clock to a primitive mode of farming. While organic agriculture does build on traditional knowledge and practices, what it offers is a modern, ecologically intensive farming system that can perform successfully without any synthetic fertilizers or pesticides” (p. 217 Scialabba, 2007).

A return to low yield low input agricultural systems is not the answer. But modern agroecological approaches are not low yield. However, they are comparatively low input in many cases. Reducing input in most agroecosystems will provide the necessary flexibility to apply external inputs in others, without losing global sustainability. The right biotechnology is available. It can be implemented right now, provided that poor and subsistence farmers receive access to institutions that build local knowledge and spread innovation, and are not prevented from developing their own markets. The recipe for success is in the Assessment.

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